UNIVERSITY AND EDUCATIONAL NEWS.

THE Woman's Educational Association of Boston proposes to institute scholarships in summer schools for Boston school teachers, and urges women's clubs and other organizations of women interested in public-school work to establish similar scholarships, or to select at least one of their young teachers who shall be sent to a summer course. A list of eight of the chief colleges and universities offering such courses is added. During the summer of 1896 the scholarships of the Boston Association will be chiefly offered for the course in physical geography at Harvard University. The amount of money now at the disposal of the Association being small, the committee asks that contributions toward this object be sent to Mrs. R. H. Richards, Institute of Technology, Boston.

THE board of regents of the University of Wisconsin has recently made the following promotions in the faculty of that institution: Louis W. Austin, Ph. D., from instructor in physics to assistant professor in physics; Lellen S. Cheney, B. S., from instructor in general and pharmaceutical botany to assistant professor of pharmaceutical botany; Wm. S. Marshall, Ph. D., from instructor in biology to assistant professor of zoölogy; Wm. A. Scott, Ph. D., from associate professor of political economy to professor of economic history and theory. Frank C. Sharp, Ph. D., from instructor in philosophy to assistant professor of philosophy; Rodney H. True, Ph. D., from instructor in pharmacognosy to assistant professor of pharmacognosy.

THE Connecticut Dental Association has voted to petition the Yale corporation for the establishment of a dental school at Yale University.

DR. ROBERT G. REMSEN, JR., of the Class of '73, has given the New York University $3,000 toward the endowment of scholarships.

THE University of Glasgow has received £8,000 by the will of the late Dr. John Grieve, the money to be used for the foundation of a lectureship or fellowship.

THE following foreign appointments are announced: Dr. Ludwig Katheriner, professor of zoölogy and comparative anatomy in Freiburg, Switzerland; Mr. James G. Lawn, professor of mining at the South African School of Mines, Cape Town and Dr. Otto Fischer, associate professor of physiological physics at Leipzig.

DISCUSSION AND CORRESPONDENCE.

A REVIEW OF BIGELOW'S PAPERS ON METEOROLOGY AND SOLAR PHYSICS.

ABOUT a year ago the writer was so struck upon reading a paper* on the 'Inversion of Temperatures in the 26.28 Day Solar Magnetic Period' that he was led to look a second time at a previous paper by the same author, viz., a 'Report on the Relations of Solar Magnetism to Terrestrial Magnetism and Meteorology.'† A severe estimate of these papers induced the writer to study carefully such others ‡ of Prof. Bigelow's papers as have been accessible. The result is that the writer has reached a trenchant conviction that Prof. Bigelow's theories are peculiarly and wildly vagarious and that his results are meaningless. A more recent paper §

* By Frank H. Bigelow, Professor of Meteorology, U. S. Weather Bureau. Am. Jour. Sci. (3),48, p. 435.

† Report for 1891–2 of the Chief of the U. S. Weather Bureau, p. 519.

‡ *Notes on a new method for the discussion of magnetic observations.* By FRANK H. BIGELOW. Bulletin No. 2, U. S. Weather Bureau.

The polar radiation from the sun. By FRANK H. BIGELOW. Astron. and Astro-Physics. 13. p. 26.

The two magnetic fields surrounding the sun. By By FRANK H. BIGELOW. Astron. and Astro-Physics. October, 1893.

Further study of the corona. By FRANK H. BIGELOW. Am. Jour. Sci. 3, 40. p. 343.

The Solar corona, an instance of the Newtonian potential function in the case of repulsion. By FRANK H. BIGELOW. Am. Jour. Sci. 3, 42. p. 1.

Note on the causes of the variations of the magnetic needle. By FRANK H. BIGELOW. Am. Jour. Sci. 3, 42. p. 253.

The solar corona discussed by spherical harmonics. By FRANK H. BIGELOW. Smithsonian Institution, 1889.

Bulletin No. 18, of the U. S. Scientific Expedition to West Africa, May, 1890.

§ *The Earth as a magnetic shell.* By FRANK H. BIGELOW. Am. Jour. Sci. 3, 50. p. 81.

proves, upon examination, to be, again, mere iterate nonsense.

The writer is old-fashioned enough to believe that a plain person can, with some pains at least, understand the writing even of a specialist, and he is driven by a sense of sheer outrage to criticise these writings of Prof. Bigelow; not, indeed, without peculiar hesitation, for to criticise is to point out fallacy, but there is nothing such in these papers; they are too inane to be fallacious! Let the reader bear in mind that the writer's estimate of these papers has been reached only after studious and repeated reading of more than one hundred thousand such words as are sampled in the following quotations.

Speaking of the previous efforts in systematic meteorology Prof. Bigelow says: "The best efforts have been made along the lines of Thermodynamics as the moving cause and dynamical mechanics as the procession of effects; much talent, if not genius, having been expended on these mathematical and physical relations."*

Prof. Bigelow has devised a method for determining the synodic period of rotation of the sun. This method, so far as the writer can understand it, is Gauss's well-known method, in which a time interval is determined during which an unknown whole number and a known fraction of periods have elapsed; the whole number is found by dividing the interval by a known approximate value of the period; the exact period is then easily calculated. To obtain the data for this determination Prof. Bigelow claims definitely † to have made use of the aspects of the solar corona as photographed during several total eclipses, the corona being assumed to rotate with the sun and to present persistent peculiarities of form.

He goes on to say: "It is impossible to reproduce fully the process of obtaining this period, because the work is extensive; but it is so important, being the key to my development of the subject, that I will briefly indicate the method. If the sun is a magnetic sphere in which the magnetism is distributed with irregular intensity throughout the mass, in the same way that the permanent magnetism of the earth deviates from the simple law of the uniform spherical magnet, then in the field outside the sun, as far as its strength reaches into space, the lines of force being propagated through the ether, these variations of intensity will be found by an observer passing along it from point to point."* He adds that if this field reaches the earth it will change as the sun rotates and can be 'measured with almost incredible accuracy;' but we gain no clue to the method which must be some other than Gauss's method, after all, unless indeed the terrestrial magnetic elements have such a distinct fluctuation in the solar-rotation period as to enable an observer to infer the recurrence of solar rotations thereby, which Prof. Bigelow does not state explicitly; but the 26-day variation of the terrestrial magnetic elements is only brought out by averaging magnetic data at corresponding epochs in a large number of successive solar-rotation periods, and then only with great uncertainty. Prof. Bigelow does not seem to bear it clearly in mind that he has used the corona in determining this period.

Prof. Bigelow imagines three cosmical magnetic fields at the earth, viz: the 'coronal field,' perpendicular to the ecliptic due to the action of the sun as a great magnet; the 'radiant field,' in the direction of the sun's rays, and the 'orbital field,' in the direction of the earth's motion in its orbit. Speaking of the coronal field Prof. Bigelow says: "This field enters the northern hemisphere nearly parallel to the earth's axis of rotation, having been diverted from the direction perpendicular to the plane of the ecliptic by the rotation of the earth on its axis, the other component having been screened off or used up in connection with the earth's permanent magnetism, which may be the true origin of the force which gives it a slow secular variation.† At this place we interpose the remark that the position is regarded as proven that the sun and the moon do not continuously

* Report for 1891–2 of the Chief of the U. S. Weather Bureau, p. 519.

† See p. 521 report for 1891–2 of the Chief of the U. S. Weather Bureau.

* Report for 1892–2 of the Chief of the U. S. Weather Bureau, p. 521.

† Report for 1891–92, of the Chief of the U. S. Weather Bureau, p. 522.

influence the terrestrial field by direct action as magnets."*

The coronal field *is* referred by Prof. Bigelow to the action of the sun as a great magnet; at least, while convincing himself of its existence in his earlier papers, he assumes it to be due to this action; but after reaching this conviction he appears to think it no longer necessary for the field to have a physical cause.

"The solar magnetic field represents a type of radiant energy, probably circular or spiral rotation of the ether which surrounds the sun on all sides, but of variable strength in certain solar longitudes. In other words, the earth passes through a series of hotter and cooler regions as the sun turns on its axis. One day is the equivalent of about 10,000,000 miles. Since the form of energy is magnetic, which, of course, means a special form of ether motion, this energy approaching the earth, itself a magnetic body capable of conducting the lines of force better in some directions than in others, is concentrated or focussed in the magnetic ovals surrounding the magnetic and geographical poles. The form of the regions of concentration came out fully in my study of the equatorial radiant field. Thus the atmosphere around the polar regions is intermittently heated or cooled, according as more or less of this polar energy falls upon it, the temperature being a direct function of the radiant energy."†

The idea that vortex motion of the ether constitutes magnetic field is, as yet, mere speculative theory‡ intensely interesting, coming from such masters as Lord Kelvin and Clerk Maxwell; supremely foolish, coming from one who, for example, uses the word 'spiral' in speaking of it, or from one who thinks a magnetic field to be a stream of energy!

"As already described, besides the coronal field perpendicular to the plane of the ecliptic near the earth, there is another field, in the plane of the ecliptic, called the radiant field, agreeing with the direction of the ether energy of light and heat emitted from the sun. It originates in the electric discharges between the atoms of the photosphere, is electro-magnetic, is propagated with the velocity of light, and in the atmosphere of the earth and in the earth itself undergoes a complex series of transformations of energy, by which the short, rapid waves are lengthened or destroyed, the work thus used up appearing in transformations of physical phenomena."*

"The finally constructed field surrounding the earth is exceedingly complex, and a description of it here is quite impossible, though some of the leading features of it may be mentioned. The fundamental law of the entry and departure of the forces from the earth conforms to the tangent law of magnetic refraction, the index being about 1.25. In the northern hemisphere the field (Radiant Field) points towards the sun, in the southern away from the sun, so that the earth is in a magnetic couple, the radiant field showing a potential fall from the sun outwards. The plane of symmetry of the field is not on the meridian of the sun, but is thrown westward by the rotation of the earth, through an angle of about 23° in the northern and 15° in the southern hemisphere. The field shows a series of five parts, gradually changing within their areas, but discontinuous as to each other. These are the polar field, the north midlatitude field, the equatorial field, the south midlatitude field, and the south polar field. The polar field is three or four times as strong as the others, in which the forces concentrate in two polar points and act along the meridians; the northern field points across the meridians, the discontinuity being along the belt of the auroral maximum of frequency; the equatorial field points north or south, and the southern field across the meridians, away from the sun. The strength of the radiant field is about 0.000135 c. g. s., being a little greater than the coronal field. A complete discussion of the numerous physical problems arising from these facts cannot now be attempted, but great light is thrown upon many of the observed physical phenomena that have been perplexing to scientific research. It seems especially to confirm in a marked degree the theory of Maxwell regarding the electro-magnetic constitution of the radiant ether waves."† "The surprising identification of magnetic and light action of the radiations of the sun in direction will be recognized as harmonizing with the conclusions arrived at by Maxwell and Hertz in their investigations."‡

Now, the magnetic field in light and heat waves is at right angles to the ray and is reversed in *direction* millions of millions of times per second! It is to be noticed that Prof. Bige-

* Bulletin No. 2, U. S. Weather Bureau, pp. 7-8.

† Astron. and Astro-Phys., 13, p. 37.

‡ Compare Prof. Oliver Lodge, London Electrician, Jan. 18, 1895, p. 332.

* Report for 1891-92, of Chief of Weather Bureau, p. 254.

† Report for 1891-92, of the Chief of the Weather Bureau, pp. 524-525.

‡ This is verbatim quotation. The reference has been lost among the mass of the writer's notes, and cannot be recovered with reasonable labor.

low considers the 'coronal' field to be a stream of energy. If such is the case it is of course not a magnetic field, but he surely so considers it and has determined its strength C. G. S! as he has also determined the strength of the 'Radiant' field and of the 'Orbital' field!

Forgetting the essential character of his corona Prof. Bigelow, in a recent paper,* 'adopting J. J. Thomson's language,' scrambles wildly after a conception of the sun's corona as a stream of matter.

"It should be noticed that there may be found in this polar radiation the true cause of the great changes of temperature in the polar regions, known in the glacial epoch."† "It is hoped that the developments of the case may not lead to any permanent difficulties that cannot be overcome, for the following reason: In a final analysis it appears that all these phenomena are to be referred to Newton's Law."‡

The passages here quoted from Prof. Bigelow's papers do not suffer by extraction from the context. Very few passages are specific enough to be quoted to any purpose whatever, and it is this fact which has governed the present choice. The paragraph referring to 'a diagram of magnetic centers,' page 523 of the Report for 1881–2 of the Chief of the United States Weather Bureau, is a fair sample of the involved vacancy of Prof. Bigelow's style. Yet curiously enough, *being entirely devoid of conceptions*, it at first strikes one merely as something one does not understand.

"In two papers § already published, a brief statement has been presented of the lines of evidence that tend to prove the following facts: 1. That the sun emits two distinct types of radiant energy into the space outside of its surface. 2. That the first is propagated radially in all directions, the part falling upon the earth, especially on its equatorial belt, being an electro-magnetic wave, whose electro-motive force

$$\int (Xu + Yv + Zw)d\tau,\|$$

by the law of the conservation of energy, breaks up into the dynamic wave

$$\int \left(u\frac{dF}{dt} + v\frac{dG}{dt} + w\frac{dH}{dt}\right)d\tau$$

partly inductive and partly magnetic in its instantaneous state, plus the static or potential stress.

$$\int \left(u\frac{d\psi}{dx} + v\frac{d\psi}{dy} + w\frac{d\psi}{dz}\right)d\tau$$

plus the irreversible energy of Joules' (*sic.*) heat

$$\int \frac{u^2 + v^2 + w^2}{C}\,d\tau\,"*$$

The mathematical discussion in this paper (Astron. and Astro-Phys. 13, p. 26) begins and ends with this quotation. It is in no way a conclusion to anything gone before, nor the beginning of anything to be finished afterwards. As to what it really is, the writer's opinion is already sufficiently expressed. Those who can recognize the bricks in it will have no difficulty in judging for themselves. A passage of the same character occurs pp. 95–96, Vol. 50, Am. Jour. Sci.:

"The real order of events in Nature may, however, be summarized as follows: The Equatorial Field generates a tropical high pressure, and a sub-polar low pressure belt, by its distribution of temperature. The continents rearrange these belts so that in winter the small polar circuit surrounding the Icelandic permanent low supersedes and predominates, while in summer the great midlatitude circuit regains its supremacy. Therefore in winter the circulation of the polar circuit is more rapid; being smaller in diameter, the supply comes across the North American polar regions, and but little from the Pacific; in summer the slower eastward march in the wider circuit sets in, with the supply from the Pacific. In both cases the movement of the air masses is dominated by the varying intensities of the polar magnetic field from the sun, by which the densities of the contents of the unit volume is changed. High pressure areas are the primary products of these sources of energy, being in part whirled up by the general circulation, and in part the result of reducing the polar absorption by diminution of the cosmical energy on certain dates.†

This is not so distinctly articulate nonsense, by far, as are the more theoretical parts of Prof. Bigelow's papers, for there *is* such a thing

* See Am. Jour. Sci., 3, 50, p. 83.

† Astron. and Astro-Phys., 13, p. 39.

‡ Bulletin No. 2, U. S. Weather Bureau, p. 9.

§ American Meteorological Journal, Sept., 1893, Astron. and Astro-Phys., Oct., 1893 (Prof. Bigelow's Reference).

‖ No reference whatever to the significance of the symbols nor to the source of the expressions.

* Astron. and Astro-Phys. 13, p. 26.

† Am. Jour. Sci., 348, p. 449.

as a high or a low pressure area, such a place as the North American polar region and a Pacific Ocean.

The reader will find sets of curves* showing such coincidences as Prof. Bigelow thinks to have discovered between certain periodic phenomena of terrestrial magnetism and certain periodic meteorological phenomena. The writer is unable to give any definite help towards a clear understanding of these curves, indeed, "A complete exposition of the data is impossible in this connection, and therefore no values are assigned to the ordinates of the several curves."†

In conclusion, let it be said that the writer has had occasion to examine irrational writing before, but he has never encountered such froth till now. The more excusable nonsense, and often the more evident, is that which is built, it may be with care, upon false conceptions; but these papers of Prof. Bigelow's are devoid of all conceptions, and at best they are mere pretension.

The writer begs the reader's indulgence in what may seem to be undue severity in this, to the writer, questionable business; but having been vexed with it for more than a year, between the difficulty of bringing it to an end, on the one hand, and the impossibility of putting it aside, on the other, he is now chiefly anxious to be done with it, and is inclined to give, with a minimum of argument and example, the plainest and sternest statement of fact.

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DR. BRINTON ON KEANE'S 'ETHNOLOGY.'

TO THE EDITOR OF SCIENCE: In SCIENCE, March 20th, Dr. Brinton has a notice of my *Ethnology*, which is so manifestly unfair that I will ask you to allow me a little space for a brief reply. The 'title is an error,' because I take ethnology to be 'nearly synonymous with anthropology as employed in modern science.' On the contrary, I carefully distinguish between *general* anthropology, which, of course, covers 'all branches of knowledge whose subject is man,' and *special* anthropology, to which ethnology is 'complimentary' (pp. 1-2). Dr. Brinton does not call attention to these distinctions, thus leaving himself convenient scope to quibble and misrepresent.

My theory of races 'is a modern recast of that of Blumenbach.' Not so; on this point I reject Blumenbach and state in the clearest language that 'Linné's original fourfold division must be upheld' (p. 222). Blumenbach's Malayan race is 'explained away as partly Ethiopic, partly Caucasic.'' Rejecting Blumenbach's five divisions, I had no occasion to 'explain away' his 'Malayan race.' Nor do I represent this race as 'partly Ethiopic, partly Caucasic,' but 'distinctly Mongoloid, one might almost say Mongolic without reservation' (330).

I refer to opponents as 'eccentric or reckless or extravagant.' These epithets are used sparingly and never personally, but only in reference to strange or impossible theories, such as: 'evolution with a jump' (p. 235), and the like.

I 'do not hesitate to strain a point to defend his [my] opinion,' and Virchow on the Neanderthal skull is given as a proof. Here the point is strained, not by me, but by Dr. Brinton, who omits Virchow's last word on the subject, which is that he never maintained 'the *absolutely* pathological character of the skull' (p. 424). This, no doubt, leaves Dr. Brinton *im Stiche*, but that is no reason why he should bring false charges against me.

I claim 'as original' to myself, amongst other theories, 'the relationship of Basques and Berbers.' No! what I claim as original is my 'general treatment of * * * the Ibero-Berber question' (xv.), which Dr. Brinton knows is quite a different thing.

"The relationship of the members of the various races is shown by 'family trees,' an ancient and misleading device." These trees are not 'ancient;' they are mine; or will Dr. Brinton tell us where else he has seen them? But they are 'necessarily misleading;' yes, if the accompanying text be overlooked, and the branches wilfully entangled, and then notes of exclamation added as thus: "The Teutons and Slavs are on a different branch!" The Teutons and

* Report for 1891-2, of the Chief of the Weather Bureau, plate IV., Am. Jour. Sci., 3, 48, p. 448.

† Report for 1891-92, of Chief of the Weather Bureau, p. 525.